



Checklist of the genus *Quercus* (Fagaceae) of Aguascalientes, México

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Abstract: Twenty-five species of *Quercus* were collected in the state of Aguascalientes, 11 members of *Quercus* sect. *Lobatae* (red oak) and 14 members of *Quercus* sect. *Quercus* (white oak). Ten species were newly recorded. *Quercus potosina* is the commonest and most widely distributed species in the state. Eight species were found only in a single municipality, Calvillo or San José de Gracia. The species of *Quercus* are mainly distributed in oak and pine-oak forest in the western part of Aguascalientes. The municipalities with the greatest numbers of species are San José de Gracia, Calvillo and Jesús María, while Aguascalientes, Asientos, Cosío, El Llano, Rincón de Romos, Pabellón de Arteaga, and Tepezalá have the fewest representatives. San Francisco de los Romo is the only municipality without any *Quercus* records.

Key words: oaks; species inventory; new records

INTRODUCTION

The genus *Quercus* L. is among the most ecologically important forest species because *Quercus* species are dominant in many plant communities (NIXON 2006). *Quercus* forests are the most characteristic plant communities of the mountainous areas of México. Along with pine forests, oak forests are the most widespread vegetation found in these temperate and semi-humid climates. But, *Quercus* species are not limited to these climates. Their extensive ecological amplitude is associated with the mountain cloud forests, as well as various types of tropical forests and grasslands (RZEDOWSKI 2006).

The highlands of central and eastern México are an important center for genus diversity of the genus (NIXON 1993b). According to ZAVALA (1998), due to environmental characteristics, oak species are not evenly distributed within México. Oaks occur from sea level up to 3100 m, although more than 95% of Mexican *Quercus* species are found between 1200 and 2800 m. Oaks are found in all Mexican states, including the smaller and less diverse states, such as Aguascalientes, with the exception that

none occur in Yucatán (RZEDOWSKI 2006).

In Aguascalientes, one of the smallest of the Mexican states, two major physiographic units are recognized: xerophytic and temperate. The eastern half of the state is a semiarid region where drier conditions predominate. This portion of the state consists of a broad valley bounded by a system of plateaus and low hills in the far east. Plant communities of this region are typical of a semi-arid climate and include crasicaules or thorny scrub, mesquite forests, and grasslands. The western half of the state is mountainous with a complex topography of mountains, plateaus, and canyons. This region is dominated by oak and oak-pine forests in the higher mountains, while in the extreme southwest there are tropical elements represented by a small portion of tropical deciduous forest in the valley of Calvillo.

Botanically, Aguascalientes was barely explored until 1980, when the “Flora del Estado de Aguascalientes” project was initiated. Since that time, floras have been published on aquatic plants, cacti, grasses, medicinal plants, legumes, oaks, pines, and composites among others (DE LA CERDA 1996, 1999a; GARCÍA 1999a, 1999b; SIQUEIROS 1996, 1999a, 1999b). McVAUGH (1974) published previous floristic records about the *Quercus* of Aguascalientes in “Flora Novogaliciana”. This region includes the states of Jalisco, Colima and Aguascalientes, and portions of Nayarit, Durango, Guanajuato, Zacatecas and Michoacán. McVaugh reported 44 species of oak in New Galicia, 11 of which were from Aguascalientes. Later, DE LA CERDA (1989, 1999b) reported 15 and 17 species, respectively. The goal of this study is to present a complete checklist and to update the floristic inventory of *Quercus* species in the state of Aguascalientes.

MATERIALS AND METHODS

Study site

At 5,680 km², Aguascalientes is the third smallest state in México. It is located between 21°38'03" N and 102°07'06" W

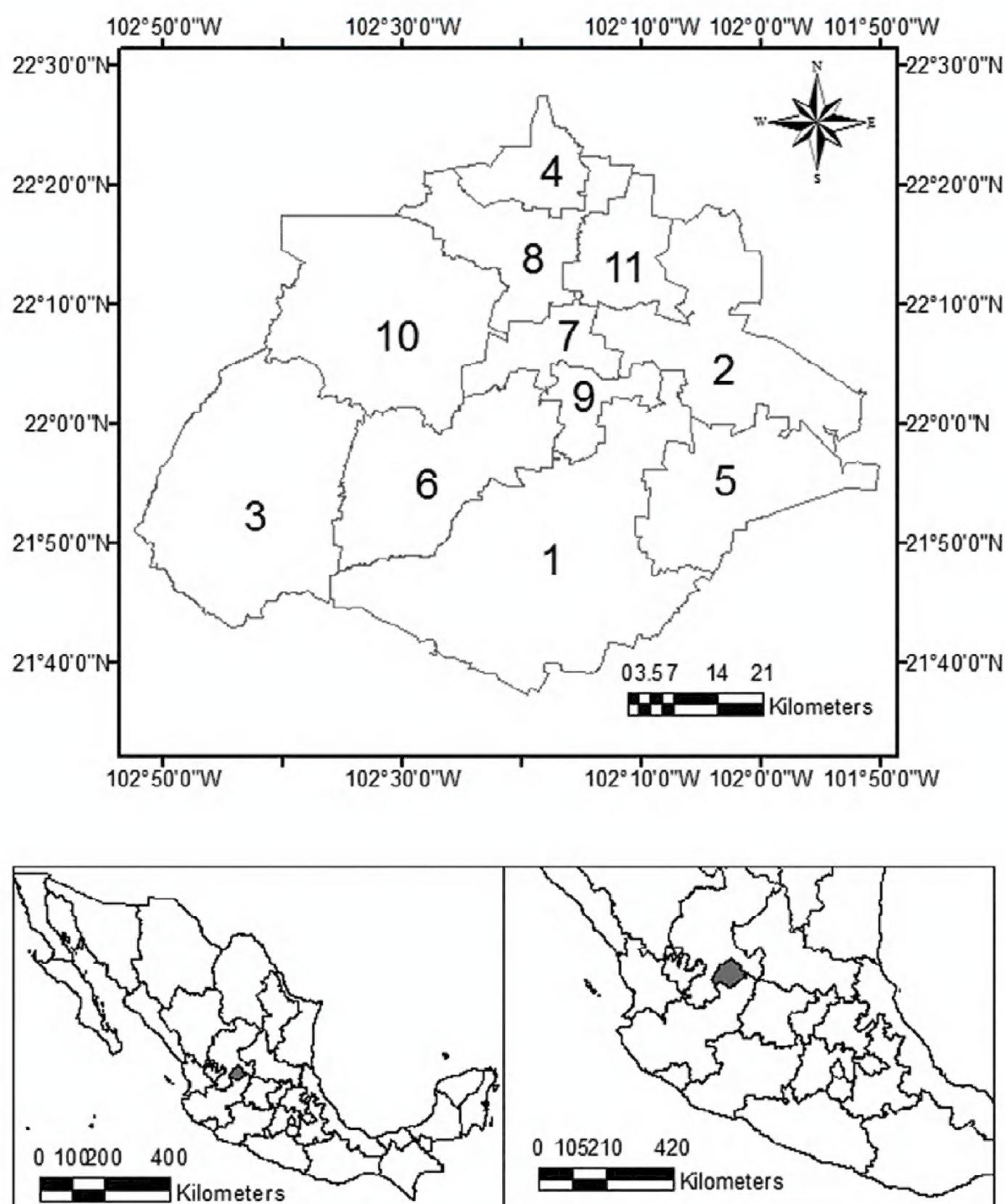


Figure 1. Map and location of Aguascalientes, México. **1:** Aguascalientes. **2:** Asientos. **3:** Calvillo. **4:** Cosío. **5:** El Llano. **6:** Jesús María. **7:** Pablo de Arteaga. **8:** Rincón de Romos. **9:** San Francisco de los Romo. **10:** San José de Gracia. **11:** Tepezalá.

in the central part of México. It is bordered by Zacatecas to the north, east and west, and by Jalisco to the south. Aguascalientes is divided into 11 municipalities: Aguascalientes, Asientos, Calvillo, Cosío, El Llano, Jesús María, Pablo de Arteaga, Rincón de Romos, San Francisco de los Romo, San José de Gracia, and Tepezalá (Figure 1). The state is included within three physiographic provinces: Western Mother Mountains (to the northwest), Central plateau (central part from north to south), and Trans-Mexican volcan belt (southwest) (CONABIO 2008). The predominant physiography of Aguascalientes is a great central plain, with some lower elevations, covered with xerophytic thorny scrub. The more common species found are *Acacia farnesiana* (L.) Willd., *Prosopis laevigata* (Humb. & Bonpl. ex Willd.) M.C.Johnst., *Mimosa biuncifera* Benth., and *Opuntia streptacantha* Lem., among others. A mountainous region covered with coniferous and oak forest is located in the northwest portion of the state at elevations that range from 1570–3020 m, with an average temperature range between 16.0–18.0°C. To the southwest of the state, there is a disturbed subtropical area covered with

dry tropical forest where these dominant taxa are found: *Bursera fagaroides* (Kunth) Engl., *Ficus petiolaris* Kunth, *Leucaena esculenta* Benth., *Lysiloma microphyllum* Benth., and *Myrtillocactus geometrizans* Console (DE LA CERDA & SIQUEIROS 1985). The annual average temperature is between 20.0–22.0°C. Most of the state is semiarid (86%); the remaining 14% is temperate (CONABIO 2008).

Data collection

The study included plants collected throughout the state from 2010 to 2015, collections from the herbarium HUAA were also included. One hundred and twenty sites were sampled to cover the whole *Quercus* forest distribution in Aguascalientes (Figure 2). Vegetation types of Aguascalientes are according to SIQUEIROS et al. (2016) (Figure 3). Species of *Quercus* were identified using specialized literature (DE LA CERDA 1999b; ESPINOSA 2001; GONZÁLEZ 1986; McVAUGH 1974; ROMERO et al. 2014). The *Quercus* checklist is organized alphabetically by species; material examined includes localities organized alphabetically by

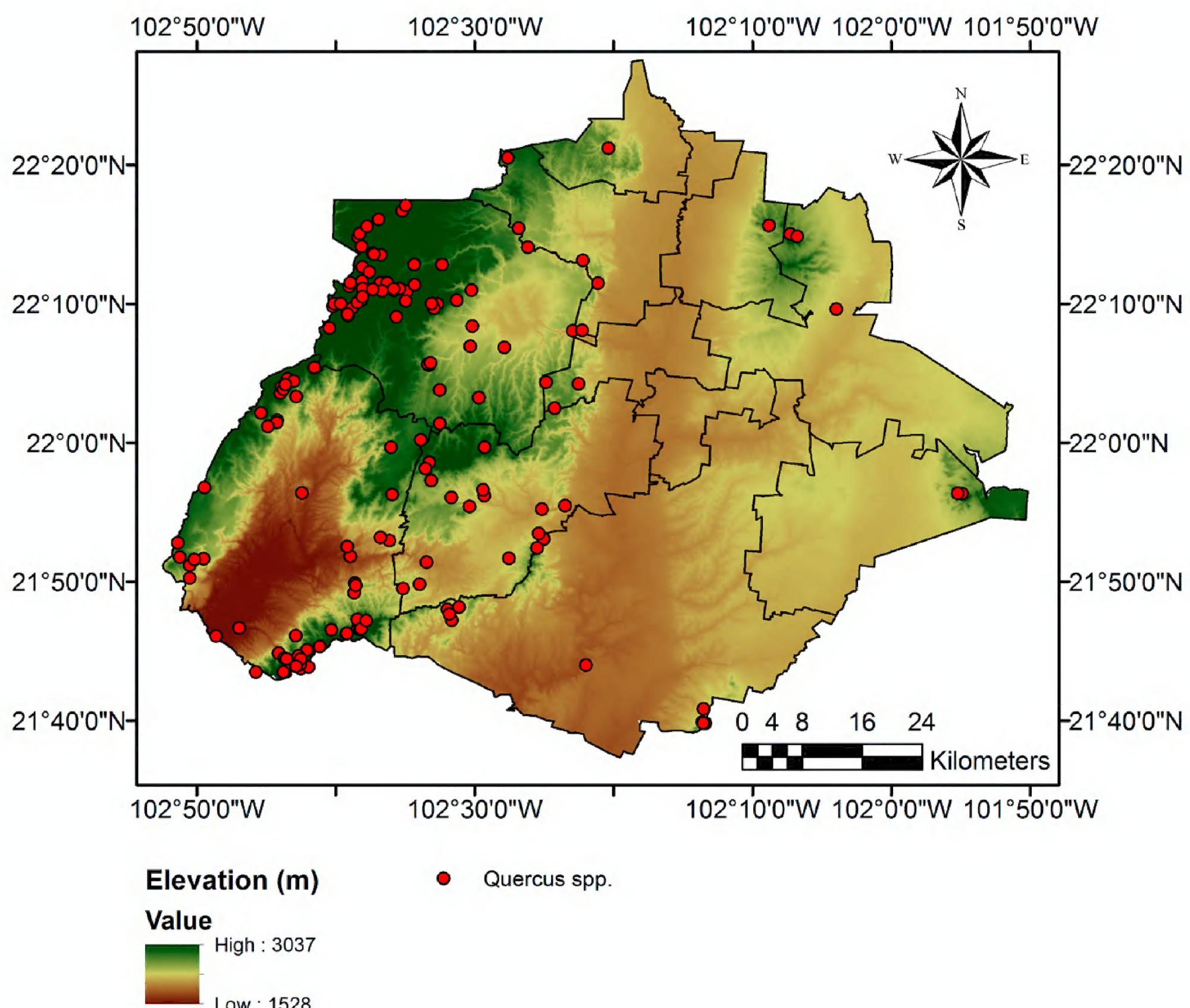


Figure 2. Map of elevation and sampling sites of genus *Quercus* in Aguascalientes, México. Borders of municipalities are shown. (Map by Victor M. Mtz. Calderón).

municipality, plant communities, elevation, collection number, collector, and voucher. Samples lacking a collection number are labeled *s/n* (Table 1.). Additional information was extracted from collected materials from Aguascalientes and specialized literature. All specimens are from Aguascalientes and are deposited at herbarium HUAA.

RESULTS

This study recorded 25 species of oaks from Aguascalientes, including 11 members of *Quercus* sect. *Lobatae* (red oak) and 14 members of *Quercus* sect. *Quercus* (white oak) according to the infrageneric classification of NIXON (1993a) (Table 1.). Ten species were newly recorded from the state: *Q. depressipes*, *Q. deserticola*, *Q. durifolia*, *Q. greggii*, *Q. magnoliifolia*, *Q. mexicana*, *Q. obtusata*, *Q. praeco*, *Q. repanda* and *Q. striatula*.

Quercus chihuahuensis, *Q. eduardii*, *Q. grisea*, *Q. laeta*, *Q. potosina*, and *Q. resinosa* are the most-represented species in Aguascalientes, while *Q. candicans*, *Q. greggii* and

Q. mexicana are the scarcest. *Quercus potosina* is the more widely distributed oak, usually forming forests in association with *Q. eduardii*, *Q. rugosa* and *Juniperus deppeana* Steud. *Quercus candicans*, *Q. deserticola*, *Q. durifolia*, *Q. greggii*, *Q. laurina*, *Q. magnoliifolia*, *Q. mexicana* and *Q. viminea*, are distributed in temperate or subtropical environments in San José de Gracia and Calvillo, respectively (Table 2). The temperate area possesses the greatest number of oaks species in the state; it is located in the western part of Aguascalientes and possesses the highest elevations. The central plain with xerophytic vegetation, including the Asientos, Cosío, El Llano and Tepezalá municipalities, have the fewest number of species with a dominance of *Q. potosina*. Species of *Quercus* are found in all municipalities of Aguascalientes, except San Francisco de los Romo. Oaks in Aguascalientes inhabit mainly oak forest and pine-oak forest but are also found in temperate grassland and areas with a climate that is transitional between subtropical and arid; oaks occur at an average elevation of 2000–2600 m (Figure 2).

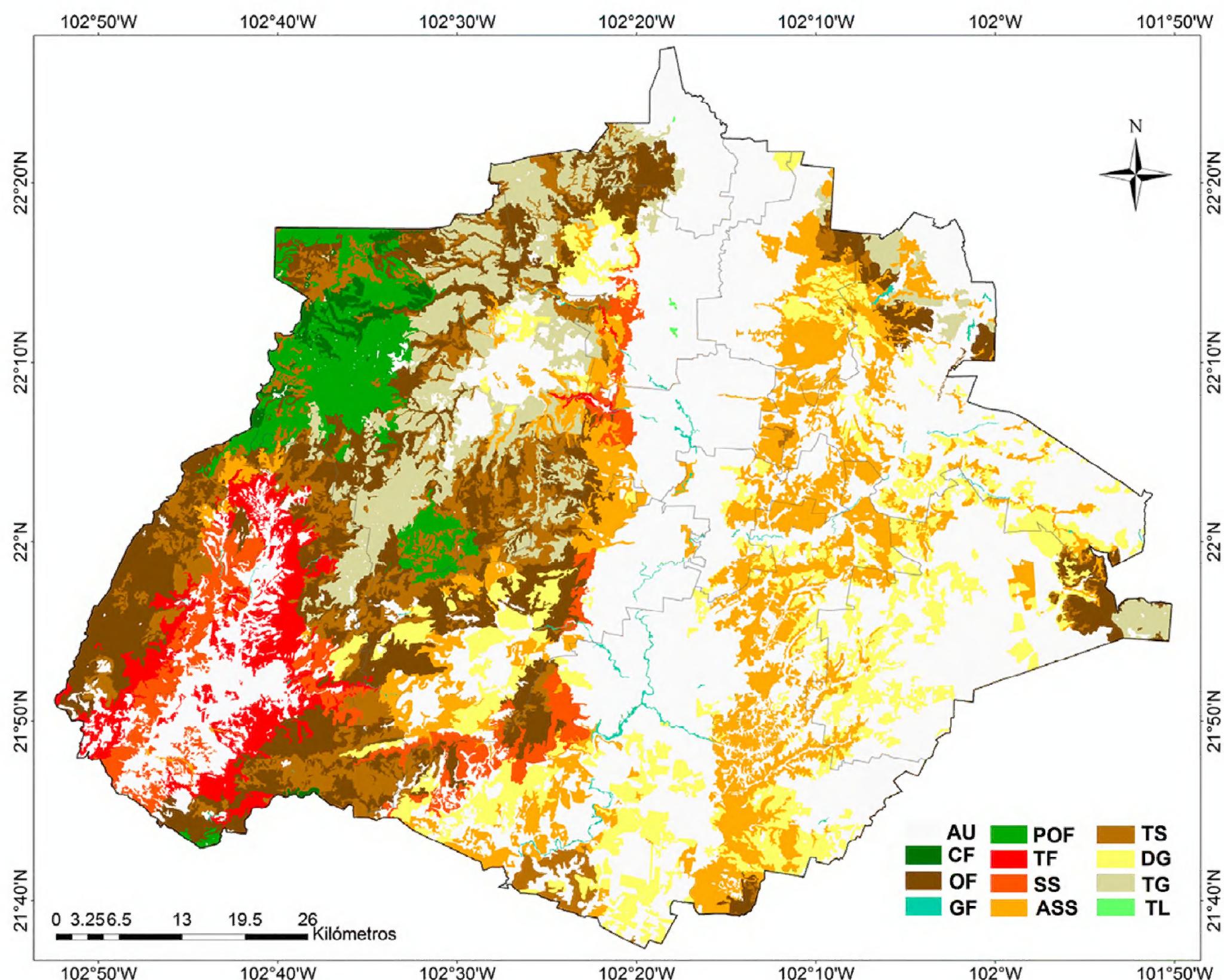


Figure 3. Vegetation of Aguascalientes, Mexico. AU: Agriculture-urban. CF: Coniferous forest. OF: Oak forest. GF: Gallery forest. POF; Pine-oak forest. TF: Tropical forest. SS: Subtropical scrub. ASS: Semiarid scrub. TS: Temperate scrub. DG. Desert grassland. TG: Temperate grassland. TL: Tular.

List of species

Quercus aristata Hook. & Arn. Figure 4A.

Quercus aristata HOOKER & ARNOTT (1841): 444. — GONZÁLEZ (1986): 31; McVAUGH (1974): 11.

Q. productipes TRELEASE (1924): 140. — GONZÁLEZ (1986): 31.

Material examined: Table 1.

Tree of 4–12 m high. Leaf coriaceous, of 7–12 × 2–6 cm, elliptic-lanceolate or elliptic-ob lanceolate, sometimes obovate, with 1–5 aristate teeth at the leaf margin, apex obtuse, rounded or acute, ending in awn, upper surface lustrous and glabrous, lower surface glabrescent, base cordate to rounded. Fruit annual, cupule hemispherical, nut ovoid-rounded of 12 mm.

In México, this species is distributed in the states of Aguascalientes, Jalisco, Guanajuato, Guerrero, Nayarit and Sinaloa. It is scarce in Aguascalientes, and has been found in the municipalities of San José de Gracia, Calvillo and Jesús María in oak and pine-oak forests from 2028–2570 m.

Quercus candicans Née. Figure 4B.

Quercus candicans NÉE (1801): 277. — GONZÁLEZ (1986): 35.

Q. calophylla SCHLECHTENDAL & CHAMISSO (1830): 79. — GONZÁLEZ (1986): 35.

Material examined: Table 1.

Tree of 8–18 m high. Leaf coriaceous, of (9)13–22 (–28) × (3.5)7–11(–16) cm, obovate, oblong-obovate or ob lanceolate, with 10–13 awned teeth at the leaf margin, apex acute or acuminate, ending in awn, upper surface lustrous and glabrous, lower surface tomentose and whitish, base subcordate to round. Fruit biannual, cupule hemispherical, nut ovoid 15–18 × 11–16 mm.

Distributed in Colombia and México, where it is found in the states of Aguascalientes, Chihuahua, Chiapas, Distrito Federal, Durango, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Oaxaca, Puebla, San Luis Potosí, Sinaloa, and Veracruz. In Aguascalientes, it was only found in Calvillo municipality in humid oak forest, from 2256–2400 m.

Table 1. Species checklist of oaks (Fagaceae) in Aguascalientes, México, ordered by section.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
LOBATAE					
<i>Q. aristata</i> Hook. & Arn.	Calvillo	1.5 km E of Dam los Alamitos, Sierra del Laurel, 21°43'51" N, 102°41'57" W, Path to Los Alisos, Sierra del Laurel, 21°44'26.71" N, 102°43'45.81" W Las Moras, 21°46'06.8" N, 102°42'52.1" W	Oak forest Oak forest	2430 2028	Rosales 3854 (HUAA 19951) De Alba s/n (HUAA 19998)
Jesús María		Gully La Sauceda, 21°58'36" N, 102°33'15" W	Oak forest	2350	De la Cerdá 2782 (HUAA 5144)
San José de Gracia	Calvillo	Los Charcos (Sierra Fría) Gully los Hoyos, 22°11'31.2" N, 102°38'56.7" W	Pine-oak forest Pine-oak forest	2570 2500	Martínez-Ramírez 1937 (HUAA 28598) De la Cerdá s/n (HUAA 1125) De la Cerdá 2780 (HUAA 4991)
<i>Q. candicans</i> Née	Calvillo	Gully Oscura, N of Sierra del Laurel, 21°46'40" N, 102°38'12" W Sierra Fría Gully Oscura, 0.5 km SE of Rancho Boca Oscura, 21°46'37" N, 102°38'09" W	Oak forest Pine-oak forest Oak forest with elements of cloud forest	2400 1880 2256	De la Cerdá & García 1335 (HUAA 4089) Arteaga 11404 (HUAA 4213) Martínez-Ramírez 1933 (HUAA 28562)
<i>Q. castanea</i> Née	Calvillo	Stream El Ocote, 3 km N-NE of El Terrero. Sierra del Pinal, 21°51'36" N, 102°49'28.88" W 1 km S of Terrero del Refugio, 21°51'10" N, 102°50'31" W. La Ciénega (Los Alisos), 21°44'09" N, 102°42'56" W 2 km NW of Terrero del Refugio, 21°52'48.75" N, 102°51'22" W Gully El Huarache 1.7 km NW of El Terrero del Refugio, 21°51'46" N, 102°51'14.6" W Gully of Arroyo Ojocalentillo, 1 km N of Las Joyas, 21°45'16" N, 102°39'12" W	Oak forest Relict oak forest Pine-oak forest Oak forest Oak forest-temperate scrub Pine-oak forest Pine-oak forest	2300 2000 2300 2325 2293 2327 2570	Rodríguez 603 (HUAA 12135) García 4932 (HUAA 4932) García 2561 (HUAA 6024) De la Cerdá 5824 (HUAA 13192) Martínez-Calderón 30 (HUAA 29913) Martínez-Ramírez 1967 (HUAA 28607) Martínez-Ramírez 1938 (HUAA 28595)
San José de Gracia		Gully La Sauceda, 21°58'36" N, 102°33'15" W Laguna Seca, Sierra San Blas de Pabellón, 22°11'06" N, 102°38'03.61" W 8.11 km N of Temazcal, 22°04'26" N, 102°43'01" W 0.5 km S of El Aldeano, 18 km W of La Congoja, 22°09'16" N, 102°39'08" W	Oak forest Oak forest Pine-oak forest	2660 2556 2695	Rosales 3801 (HUAA 23066) Adame & Rosales 1173 (HUAA 21826) Martínez-Ramírez 1942 (HUAA 28676)
<i>Q. durifolia</i> Seemen*	San José de Gracia	Hillside NW of Hill El Picacho, 21°53'27" N, 102°25'23" W 16 km NW of La Congoja, S hillside of Cerro El Pujido, 22°14'08" N 102°38'08" W	Oak forest Pine-oak forest	2404 2839	Martínez-Calderón 100 (HUAA 19918) Martínez-Ramírez 2113 (HUAA 19919)
<i>Q. eduardii</i> Trel.	Aguascalientes	Hillside NW of Hill El Picacho, 21°53'27" N, 102°25'23" W 1 km W of Ignacio Zaragoza, path to Cerro del Muerto, 21°51'41.2" N, 102°27'32" W Cerro de Los Gallos, 500 m NW of the antennas, 21°39'54" N, 102°13'15" W 2 km NW of El Ocote, 21°47'40.8" N, 102°31'49.9" W	Temperate scrub Temperate scrub Oak forest Temperate scrub	2100 2050 2100 2300	De la Cerdá & García 1011 (HUAA 1110) De la Cerdá 6083 (HUAA 14645) González 1391 (HUAA 21859) Martínez-Calderón 85 (HUAA 29920)
Calvillo		Los Alamitos, 21°43'64" N, 102°42'82" W Los Alisos, 21°44'29" N, 102°43'42" W 5 km NW of El Terrero, 22°02'09.67" N, 102°45'22.41" W Hillside E of El Cerro de la Mesilla, Sierra del Laurel Gully Oscura, N of Sierra del Laurel, 21°46'40.6" N, 102°38'12.3" W Las Moras, 21°46'06.8" N, 102°42'52.1" W Arroyo Ojocalentillo, 1 km N of Las Joyas, 21°45'16" N, 102°39'12" W	Oak forest Oak forest-tropical forest Temperate grassland Pine-oak forest Oak forest Pine-oak forest Oak forest	2300 2035 2000 2450 2400 2350 2100	De la Cerdá 6301 (HUAA 15283) Rosales 3807 (HUAA 23069) De la Cerdá & García 1533 (HUAA 1092) Rodríguez 285 (HUAA 9557) De la Cerdá & García 1339 (HUAA 78) De la Cerdá 2783 (HUAA 5145) Martínez-Ramírez 1963 (HUAA 28600)
Jesús María		Hillside E of Dam El Capulín, 21°49'31.1" N, 102°35'10.6" W 2 km N of Milpillas de Abajo, 21°57'16.62" N, 102°33'07.80" W 1.5 km SW of Dam San Rafael 2 km N of Gracias a Dios, 21°56'37.50" N, 102°29'23.49" W Stream El Mirador, 4 km W of Los Miradores, 21°47'33" N, 102°36'31" W 1 km SW of Gracias a Dios, 21°55'24.78" N, 102°30'21.72" W 2 km SE of Dam El Capulín, 21°49'48" N, 102°33'58" W	Oak forest Temperate scrub Pine-oak forest Temperate scrub Oak forest Temperate scrub Pine-oak forest	2100 2350 2050 2100 2344 2050 2000	Vega 201 (HUAA 4082) Vega 189 (HUAA 4062) Ramírez 45 (HUAA 4080) Martínez-Ramírez 1957 (HUAA 29565) Vega 40 (HUAA 4059) Vega 91 (HUAA 4090)

Continued

Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
Pabellón de Arteaga	Hillside W of El Garabato		Vestigial oak forest	2050	Rosales 3230 (HUAA 7745)
Rincón de Romos	Gully Juan Caporal, 22°15'26" N, 102°26'50.2" W	Oak forest		2112	Siqueiros 4695 (HUAA 23070)
San José de Gracia	NW of Congoja, Sierra Fría, 22°11'22" N, 102°34'19" W	Pine-oak forest		2400	Loera et al. s/n (HUAA 23465)
	Path to Dam de La Araña, 22°13'35.73" N, 102°37'15.42" W	Pine-oak forest		2350	García s/n (HUAA 480)
	Gully Las Cazuelas	Pine-oak forest		2350	Cuellar et al. 41 (HUAA 8765)
	12 km on terrace near La Congoja-El Temazcal, 22°09'43.78" N, 102°38'49.41" W	Oak forest		2730	Nieto 3 (HUAA 23578)
	Ca 8.5 km NW of La Congoja, 22°13'32.75" N, 102°36'44.26" W	Pine-oak forest		2730	Sabas et al. 13 (HUAA 23663)
	800 m from Gully de Chupaderos	Oak forest		2430	Gutiérrez 58 (HUAA 5466)
	Gully Piletas, Sierra Fría, 22°11'31.42" N, 102°36'17.03" W	Pine-oak forest		2450	De la Cerdá & García 480 (HUAA 7002)
	Rancho el Zepo (Sierra Fría), 22°11'04.55" N, 102°35'49.29" W	Oak forest		2570	De la Cerdá & García s/n
	7.78 km NW of El Temazcal, 22°04'01.55" N, 102°43'54.31" W	Oak forest		2530	González 1162 (HUAA 21835)
	10 km W of La Congoja, 22°09'45.26" N, 102°39'07.23" W	Pine-oak forest		2530	García s/n (HUAA 50)
	Agua Zarca Biological Station, 22°05'35.58" N, 102°33'17.41" W	Oak forest		2200	Rosales 1480 (HUAA 16517)
	Cañada "Agua Escondida", 22°11'38.8" N, 102°38'06.2" W	Pine-oak forest		2693	López 34 (HUAA 19521)
	Cabañas las Manzanillas, 1.99 km N of El Zepo, 22°11'31.38" N, 102°36'47.64" W	Oak forest		2609	González 1113 (HUAA 21796)
	0.36 km SW of Laguna Seca, 21°11'11.67" N, 102°38'11.30" W	Pine-oak forest		2687	González 1118 (HUAA 21792)
	Around La Congoja, 22°09'38.29" N, 102°32'57.33" W	Oak forest		2494	González 1109 (HUAA 21799)
	Forest station, Sierra Fría	Oak forest		2583	González & Rosales 1177 (HUAA 21821)
	3 km NW of El Temazcal, 22°05'35.58" N, 102°33'17.41" W	Oak forest		2162	González & Rosales 1152 (HUAA 21771)
	6.44 km SW of El Zepo, 21°10'58.94" N, 102°35'48.98" W	Oak forest		2618	González 1136 (HUAA 21785)
	Gully La Boquilla, 1 km E of Rancho Las Camas	Oak forest		2140	De la Cerdá & García 584 (HUAA 21877)
	Peñón Blanco 3.5 km E of La Congoja, 22°10'15.36" N, 102°31'17.24" W	Oak forest		2304	González 1104 (HUAA 21770)
	Gully el Calderón, 4 km SE of Paredes, 22°06'51.3" N, 102°27'52.8" W	Temperate grassland and oak forest		2300	Martínez-Calderón 1 (HUAA 29921)
<i>Q. gentry C.H. Müll.</i>	Calvillo		Oak forest-subtropical scrub	2250	De la Cerdá 7624 (HUAA 22087)
	1 km S of Terreno del Refugio, 21°51'36" N, 102°50'10" W,	Oak forest		2450	López 33 (HUAA 19523)
	Cañada El Pilar, to NW of Temazcal, 22°03'52.05" N, 102°43'46.35" W	Oak forest		2400	De la Cerdá & García 522 (HUAA 6963)
	Gully Oscura, 21°46'40.6" N, 102°38'12.3" W	Oak forest		2320	Siqueiros 2561 (HUAA 3831)
	8 km from Los Alisos,		Tropical forest-oak woodland	2200	De la Cerdá 6217 (HUAA 16389)
	4 km NW of Temascal, 22°01'11" N, 102°44'53" W	Oak forest-temperate scrub		2150	De la Cerdá & García 1522 (HUAA 3825)
	3 km S of Terrero, 21°50'16" N, 102°50'31" W	Oak forest		2625	García 2105 (HUAA 5147)
	La Cuchilla	Oak forest		2035	De la Cerdá 7257 (HUAA 19854)
	Los Alisos, 21°44'29" N, 102°43'42" W	Subtropical scrub-oak forest		2150	De la Cerdá & García 759 (HUAA 1126)
	1 km E of Los Alisos, 21°44'27" N, 102°42'31" W	Oak forest-subtropical scrub		2084	Martínez-Calderón 72 (HUAA 29922)
	1 km W of El Garruño, 21°44'27.0" N, 102°43'32.8" W	Oak forest		2244	Martínez-Ramírez 2389 (HUAA 29923)
<i>Q. jonesii Trel.</i>	Calvillo	Hillside E of Cerro de la Mesilla, Sierra del Laurel, 21°43'30" N, 102°43'45" W	Pine-oak forest	2450	Rodríguez 287 (HUAA 9554)
	NE of Dam Los Alamitos, 21°44'02.33" N, 102°42'32.57" W	Oak forest		2700	García 3998 (HUAA 16696)
	Mesa Las Escobas, Sierra de Laurel, 21°46'15.63" N, 102°39'13.65" W	Oak forest		2400	García 4544 (HUAA 14259)
	Las Moras, 21°46'06.8" N, 102°42'52.1" W	Pine-oak forest		2350	De la Cerdá 2781 (HUAA 5094)
	NE of Los Alisos, 21°44'40.41" N, 102°42'40.41" W	Oak forest		2350	García 2794 (HUAA 6569)
	Cerro del Laurel, 21°46'51.97" N, 102°38'14.95" W	Oak forest		2400	García 3325 (HUAA 12203)
<i>Q. María</i>		Gully, 4 km N of Milpillas, 21°58'08.4" N, 102°33'32.8" W,	Pine-oak forest	2570	Martínez-Ramírez 1940 (HUAA 28597)

Continued

Table 1. *Continued.*

Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
	Jesús María	Gully Oscura, SE of Rancho Boca Oscura, 21°46'33"N, 102°38'15"W 8 km SW of Hacienda El Garabato SW of Los Arquitos Dam 2.5 km SW of Dam San Rafael to SE Arroyo La Gloria, 21°55'13.9"N 102°25'09.8"W Canyon of Abelardo Rodríguez Dam, Arroyo La Gloria, 22°55'13.38"N, 102°24'06.06"W	Oak forest Relict oak forest Gallery forest Pine-oak forest Vestigial oak forest Gallery forest	2354 2010 1910 2050 1800 2910	Martínez-Ramírez 1931 (HUAA 28566) De la Cerdá 3480 (HUAA 8183) De la Cerdá 6512 (HUAA 16450) Vega 186 (HUAA 4065) Rodríguez 2 (HUAA 8210) González 1254 (HUAA 28787)
	Pabellón de Arteaga	Hill W of El Garabato, 22°04'15.34"N, 102°22'30.86"W	Vestigial oak forest	2050	Rosales 3230 (HUAA 28710)
	Rincón de Romos	Gully Pabellón de Hidalgo, 22°11'30.01"N, 102°21'06.98"W	Temperate scrub	2018	González 1318 (HUAA 22143)
	San José de Gracia	Dam Jocoqui, 22°08'04.5"N 102°22'55.4"W Gully Túnel de Potrerillos, 22°4'04"N, 102°26'09"W 4.5 km SW of Paredes	Vestigial oak forest Gallery forest Temperate scrub-oak Oak forest grassland-temperate scrub Pine-oak forest	1950 2050 2150 2100 2300 2500	De la Cerdá 6358 (HUAA 16297) De la Cerdá 6495 (HUAA 16403) De la Cerdá 6126 (HUAA 15284) García 2205 (HUAA 23552) De la Cerdá 7534 (HUAA 21766) De la Cerdá 2768 (HUAA 5239) García 1770 (HUAA 5878) Rosales 1754 (HUAA 21318)
		3 km SW of La Estancia, 22°08'5.8"N, 102°22'16.6"W 2 km SW of Paredes, 22°08'23"N, 102°30'10"W	Pine-oak forest	2200	
		Gully Los Planes	Oak forest	2000	
		Gully Piletas, Sierra San Blas de Pabellón	Oak forest- Temperate scrub	2038	Martínez-Calderón 60 (HUAA 29914)
		Agua Zarca Biological Station (EBAZ), 22°05'40.25"N, 102°33'23.44"W	Subtropical scrub	1900	Martínez-Ramírez 2377 (HUAA 29915)
		1.5 km NE of Rancho Viejo, 22°06'56.3"N, 102°30'19.8"W	Pine-oak forest	2244	Martínez-Ramírez 2303 (HUAA 29916)
		Km SE of Mesa Grande, 21°46'40.7"N, 102°46'56.3"W	Oak forest	2177	González 1142 (HUAA 21781)
	Pabellón de Arteaga	7.7 km SW of El Garabato, 22°04'21"N, 102°24'51"W	Temperate scrub	1910	Martínez-Ramírez 1528 (HUAA 19917)
	San José de Gracia:	Agua Zarca Biological Station 22°05'41"N, 102°33'10"W	Pine forest	2621	Martínez-Ramírez 1993 (HUAA 29924)
		Potrero del Rio, 2.5 km NW of Tapias Viejas, 21°51'24"N, 102°33'28"W	Oak forest	2100	De la Cerdá s/n. (HUAA 42)
		1 km SE of Agua Escondida, 22°11'02"N, 102°37'19"W	Oak forest	2380	Martínez-Ramírez 1700 (HUAA 29421)
		Cerro los Gallos, 21°39'49"N, 102°13'32"W	Pine-oak forest	2410	De la Cerdá & García 1164 (HUAA 7014)
	Calvillo	La Trinchera, 4 km N of Terrero del Refugio, 21°55'17.94"N, 102°30'42.22"W	Oak forest	2325	González 1142 (HUAA 3382)
		Hillside N of El Montoro	Pine-oak forest	2146	Martínez-Calderón 68 (HUAA 29925)
		Canyon Dam Abelardo Rodríguez, Arroyo La Gloria, 22°55'13.38"N, 102°24'06.06"W	Temperate grassland	2860	González & Rosales 1255 (HUAA 28786)
	Rincón de Romos	Gully of Las Palomas, Sierra Brava, 22°01'23"N, 102°32'30"W	Gallery forest	2300	González & Rosales 1215 (HUAA 28668)
	San José de Gracia	Gully Juan Caporal, 22°15'26"N, 102°26'50.2"W	Oak forest	2112	De la Cerdá 4697 (HUAA 20039)
		NW of Cañada Arroyo Pinito, 22°21'12"N, 102°20'21"W	Pine-oak forest	2500	Loera et al. 3 (HUAA 23464)
		Gully Piletas, 22°11'31.42"N, 102°36'17.03"W	Grassland-pine-oak forest	2500	García 1790 (HUAA 5962)
		Rancho El Zepo (Sierra Fria), 22°11'04.55"N, 102°35'49.29"W	Oak forest	2570	De la Cerdá s/n (HUAA 76)
		Path to Dam of La Araña, 22°13'35.73"N, 102°37'15.42"W	Pine-oak forest	2350	De la Cerdá s/n (HUAA 1986)
		2 km SE of Paredes, 22°08'23"N, 102°30'10"W	Grassland-oak forest	2100	De la Cerdá 7533 (HUAA 21744)
		Around La Congoja, 22°09'38.29"N, 102°3'57.33"W	Oak forest	2494	González 1107 (HUAA 21777)
		Agua Zarca Biological Station, 22°05'35.58"N, 102°33'17.41"W	Pine-oak forest	2400	Rosales 1755 (HUAA 21319)
		Los Alamitos, 22°10'56"N, 102°36'39"W	Pine-oak forest	2574	Martínez-Ramírez 1340 (HUAA 21118)
		Gully Rio Blanco (path to Cerro de la Ardilla) road to La Congoja, 1 km W of La Congoja, 22°09'40.7"N, 102°32'55.1"W	Pine-oak forest	2350	García s/n (HUAA 70)
		Gully "El Chupadero"	Oak forest	2497	López 21 (HUAA 19534)
		3 km SE of Gully del Tiznado	Oak forest	2400	García 2274 (HUAA 5049)
				2300	Gutiérrez 98 (HUAA 5602)

Continued

Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
<i>Q. laeta</i> Liebm.	Aguascalientes	Gully Los Planes, 22°3'14.56"N, 102°29'42.33"W	Pine-oak forest	2300	<i>De la Cerdá 2769</i> (HUAA 5205)
		Gully El Rico, 5.7 km NW of La Congoja, 22°12'50.68"N, 102°34'21.13"W	Pine-oak forest	2400	<i>Martínez-Calderón 99</i> (HUAA 29926)
		Cima del Cerro Los Azules, hillside N, 21°59'40"N, 102°29'16"W	Oak forest	2564	<i>Martínez-Ramírez 2095</i> (HUAA 28788)
		Hillside W of Cerro del Pícacho, 21°53'27.51"N, 102°25'23.65"W	Thorny scrub-subtropical scrub	2100	<i>García 2609</i> (HUAA 7048)
		Hillside S of Cerro del Pícacho, 21°53'02"N, 102°25'02"W	Oak forest-grassland	1900	<i>García 2610</i> (HUAA 6794)
		Cerro Los Gallos, 21°39'49"N, 102°13'22"W	Oak forest	2256	<i>Rosales 3865</i> (HUAA 23537)
		1 km NW of Ignacio Zaragoza, 21°51'41.12"N, 102°27'32"W	Temperate scrub	2000	<i>De la Cerdá 6084</i> (HUAA 18242)
		Cerro Los Gallos, 21°40'50.04"N, 102°12'45.4"W	Temperate scrub with oak	2100	<i>De la Cerdá 6039</i> (HUAA 15282)
		1 km NE of El Ocote, 21°47'13.58"N, 102°31'38.16"W	Oak forest	2000	<i>García 2637</i> (HUAA 6409)
		Palo Alto	Subtropical scrub	2200	<i>De la Cerdá & García 1372</i> (HUAA 1284)
Calvillo		Gully Oscura, Sierra del Laurel, 21°46'40"N, 102°38'12"W	Oak forest	2242	<i>González 1993</i> (HUAA 28715)
		2 km W of El Garruño, 21°44'22"N, 102°43'30"W	Oak forest	2120	<i>Martínez-Ramírez 1568</i> (HUAA 29460)
		1.5 km NE of El Sauz, 21°52'57.25"N 102°36'7.05"W	Oak forest	2019	<i>De la Cerdá 6558</i> (HUAA 16462)
		5 km NW of El Terrero	Temperate grassland	2400	<i>De la Cerdá & García 1536</i> (HUAA 2901)
		2 km NE of Palo Alto	Tropical forest-oak forest	1900	<i>García 2517</i> (HUAA 16698)
		S of Los Alisos, Sierra del Laurel	Oak forest	2100	<i>García 4973</i> (HUAA 17197)
		Los Alisos, 21°44'51.2"N, 102°43'65.7"W	Tropical forest-oak forest	2100	<i>De la Cerdá 6164</i> (HUAA 15287)
		La Cenega 21°44.123'N, 102° 42.178'W	Oak forest	2380	<i>González 299</i> (HUAA 19351)
		2.5 km NE of Palo Alto	Subtropical scrub	1900	<i>García 2517</i> (HUAA 6413)
		1 km W of El Garruño, 21°44'27.0"N, 102°43'32.8"W	Oak forest-subtropical scrub	2084	<i>Martínez-Calderón 69</i> (HUAA 29927)
Jesús María		2 km SE of Dam Capulín, 21°49'48"N, 102°33'58"W	Pine-oak forest	2000	<i>Vega 105</i> (HUAA 4067)
		Mesa del Pino	Oak forest	2100	<i>García 2194</i> (HUAA 5153)
		1.5 km NE of Dam Chichimeo	Thorny scrub-oak	2100	<i>Vega 246</i> (HUAA 4073)
		Ravine between Tapias Viejas and El Ocote, 21°48'10"N, 102°31'07"W	Temperate scrub	2000	<i>García 5208</i> (HUAA 23087)
		12 km S of crossroads Calvillo-Tapias Viejas	Temperate scrub with oak	2100	<i>De la Cerdá 5765</i> (HUAA 13206)
		"Km 4", highway between Tapias-El Ocote	Thorny scrub	1800	<i>García 2752</i> (HUAA 5086)
		2.5 km W of Rinconcito Lejano	Thorny scrub-oak	2300	<i>Vega 12</i> (HUAA 4074)
		1 km SW of Gracias a Dios	Temperate scrub-oak	2300	<i>Vega 37</i> (HUAA 4075)
		2 km N of Milpillas de Abajo	Thorny scrub-oak	2350	<i>Vega 202</i> (HUAA 4083)
		2.6 km E of Milpillas de Arriba, 21°56'04.0"N 102°31'41.8"W	Grassland-thorn scrub	2200	<i>Martínez-Calderón 67</i> (HUAA 29928)
Pabellón de Arteaga		Dam Abelardo Rodríguez, Steam La Gloria, 22°55'13.38"N, 102°24'06.06"W	Gallery forest	2910	<i>González & Rosales 1256</i> (HUAA 28785)
		7.7 km SW of El Garabato, 22°04'21.2"N, 102°24'51.9"W	Pine-oak forest	2244	<i>Martínez-Ramírez 2704</i> (HUAA 29929)
		SW of Dam la Araña, 22°13'40.70"N 102°37'21.80"W	Pine-oak forest	2580	<i>De la Cerdá & García 1263</i> (HUAA 4151)
		7.7 km N of El Temazcal, 22°04'01.55"N, 102°43'54.31"W	Oak forest	2530	<i>Adame & Rosales 1166</i> (HUAA 21838)
		Ranch El Sinai	Oak forest	2691	<i>González & Rosales 1181</i> (HUAA 21830)
San José de Gracia		Peñón Blanco 3.5 km E of La Congoja, 22°10'15.36"N, 102°31'17.24"W	Oak forest	2304	<i>González 1102</i> (HUAA 21774)
		3 km NW of El Temazcal, 22°01'28.30"N, 102°44'14.72"W	Oak forest	2162	<i>González & Rosales 1151</i> (HUAA 21775)
		Agua Zarca Biological Station 22°05'35.58"N, 102°33'17.41"W	Oak forest	2142	<i>González 1146</i> (HUAA 16557)
		10 km W of La Congoja, 22°09'45.26"N, 102°39'07.23"W	Pine-oak forest	2530	<i>García s/n</i> (HUAA 53)
		9 km W of San Antonio de los Ríos	Temperate scrub-oak	2270	<i>De la Cerdá 2483</i> (HUAA 4285)

Continued

Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
<i>Q. magnoliifolia</i> Née*	Calvillo	Glen on hillside W of Cerro del Pinal, 22°04'11"N, 102°43'37"W Gully La Botita, 4 km SE of Malpaso, 21°49'44.7"N, 102°38'33.7"W	Oak forest Oak forest with elements of subtropical scrub	2541 1670	Martínez-Ramírez 168 (HUAA 29931) Martínez-Calderón 103 (HUAA 29932)
<i>Q. obtusata</i> Humb. & Bonpl.	Calvillo	Cerro del Laurel Hondonada of Arroyo Ojocalentillo, 1 km N of Las Joyas, 21°45'16"N, 102°39'12"W Gully Oscura, 0.5 km E of Rancho Boca Oscura, 21°46'37"N, 102°38'09"W	Oak forest Oak forest Oak forest with elements of cloud forest Oak forest	2400 2327 2256 2327	García 1312 (HUAA 11839) Martínez-Ramírez 1965 (HUAA 28606) Martínez-Ramírez 1927 (HUAA 28570) Martínez-Ramírez 1966 (HUAA 29379).
<i>Q. potosina</i> Trel.	San José de Gracia	Arroyo Ojocalentillo, 1 km N of Las Joyas, 21°45'16"N, 102°39'12"W La Angostura, 22°5'24.5"N, 102°41'31.9"W Cañada El Carrizal, NW of Paredes, 22°10'59"N, 102°30'13"W	Oak forest Oak forest, Oak forest	2702 2100	Romo 167 (HUAA 19850) De la Cerdá 7385 (HUAA 20465)
<i>Q. potosina</i> Trel.	Aguascalientes	Cerro El Picacho, W hillside, 21°53'27.51"N, 102°25'23.65"W Hillside NW of Cerro del Picacho, 21°53'27.51"N, 102°25'23.65"W Cerro de Los Gallos, 21°39'49"N, 102°13'32"W	Oak forest Oak forest Oak forest	2100 2150 2256	García 2603 (HUAA 6510) De la Cerdá & García 1014 (HUAA 1114) Rosales 3864 (HUAA 23538)
<i>Asientos</i>		1 km NE of Ojo de Agua de Crucitas Cañada El Saucillo, 22°1'49.53"N, 102°6'46.32"W	Temperate scrub Oak forest	2100 2257	García 2953 (HUAA 16697) Rosales 1785 (HUAA 19597)
	Calvillo	Rancho Los Carrizos, 21°45'0.4"N, 102°42'4.4"W Los Alisos, 21°44'29"N, 102°43'42"W	Oak forest Tropical deciduous forest-oak forest	2350 2035	García 5380 (HUAA 22077) Rosales 3804 (HUAA 23064)
		El Pilar, Sierra San Blas de Pabellón, 22°03'52.05"N 102°43'46.35"W Hillside E of Cerro de la Mesilla, Sierra del Laurel, Hillside E, Gully El Pilar, 22°03'49"N, 102°44'16.93"W Gully Oscura, Sierra del Laurel, 21°46'40.6"N, 102°38'12.3"W El Montoro Arroyo El Ocote, 3 km NE of El Tererro, Sierra del Pinal La Cienega 2 km NW of El Tererro del Refugio, 21°52'48.75"N, 102°51'22.03"W 11.5 km SE of Malpaso	Oak forest Pine-oak forest Oak forest Oak forest Pine-oak forest Oak forest Oak forest Oak forest Subtropical scrub-oak forest	2700 2400 2400 2242 2410 2300 2300 2280 2280	García 1758 (HUAA 16686) Rodríguez 286 (HUAA 9551) Martínez-Ramírez 1674 ((HUAA 29393) González 1191 (28803) De la Cerdá & García s/n (HUAA 1111) Rodríguez 600 (HUAA 12128) García 2560 (HUAA 6538) De la Cerdá 5829 (HUAA 13191) García 3833 (HUAA 13977)
	Cosío	Cañada Arroyo Pinito, N hillside, 22°21'12"N, 102°20'21"W El Llano	Oak forest Oak forest	2325 2200	De la Cerdá & García 1403 (HUAA 3381) De la Cerdá 6649 (HUAA 16589)
	Jesús María	1 km NW of Cerro del Colorín (Sierra de Guajolotes) Dam El Capulín Cerro La Chivera Gully El Pino 2 km N of Gracias a Dios, 21°56'37.50"N, 102°29'23.49"W 2 km N of Milpillas de Abajo, 21°57'16.62"N, 102°33'07.80"W	Chaparral with oak-Pine Oak forest Oak forest Temperate scrub Temperate scrub-oak	2500 2100 2320 2500 2100 2350	Rodríguez & Soto 2 (HUAA 7809) De la Cerdá & García 1429 De la Cerdá & García 1153 (HUAA 1113) De la Cerdá 3089 (HUAA 6718) Vega 48 (HUAA 4076) Vega 204 (HUAA 4081)
	San José de Gracia	10 km W of La Congoja, 22°09'45.26"N, 102°39'07.23"W Gully Piletas, Sierra Fría, 22°11'31.42"N, 102°36'17.03"W Agua Zarca Biological Station, 22°05'35.58"N, 102°33'17.41"W Cerro de la Ardilla, 22°16'41.1"N, 102°35'13.6"W Dam La Araña, 22°13'40.70"N, 102°37'21.80"W 4 km NE of Gully de Piletas Gully Rio Blanco (path to Cerro de La Ardilla)	Pine-oak forest Pine-oak forest Pine-oak forest Pine-oak forest Pine-oak forest Pine-oak forest	2530 2450 2339 2800 2580 2400 2350	García s/n (HUAA 58) De la Cerdá 485 (HUAA 6957) Rosales 1597 (HUAA 23028) Villalobos 3 (HUAA 11661) García 1264 (HUAA 4150) Gutiérrez 44 (HUAA 5472) García s/n (HUAA 69)

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Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
<i>Q. praeceo Trel.*</i>	Gully Las Cazuelas	Pine-oak forest	2500	Cuellar et al. 44 (HUAA 8764)	
	Gully El Rico, 22°12'50.68"N, 102°34'21.13"W	Pine-oak forest	2500	García 2457 (HUAA 6134)	
	Cañada "Agua Escondida", 22°11'38.8"N, 102°38'06.2"W	Pine-oak forest	2693	López 32 (HUAA 19526)	
	Playa Mariquitas, Monte Grande Sierra Fría, 22°14'48"N, 102°38'24"W	Oak forest	2863	Siqueiros 4681 (HUAA 19935)	
	Brecha al Alamo, Cerro El Primo, Monte Grande Sierra Fría, 22°15'51"N, 102°37'45"W	Oak forest	2867	Siqueiros 4672 (HUAA 19930)	
	Mesa Alta, Monte Grande Sierra Fría	Oak forest	2973	Siqueiros 4675 (HUAA 20043)	
	Gully Laguna Seca	Pine-oak forest	2450	Gutiérrez 52 (HUAA 5471)	
	100 m W of El Zepo, 22°11'04.55"N, 102°35'49.29"W	Pine-oak-chaparral forest	2600	De la Cerdá 2428 (HUAA 4276)	
	8.5 km NW of La Congoja Sierra Fría, 22°13'32.75"N, 102°36'44.26"W	Oak forest	2614	Sabas et al. 12 (HUAA 23586)	
	Peñón Blanco, 3.5 km E of La Congoja, 22°10'15.36"N, 102°31'17.24"W	Oak forest	2304	González 1105 (HUAA 21773)	
<i>Q. repanda Humb. & Bonpl.*</i>	Forest station, Sierra Fría	Oak forest	2583	Adame-Rosales 1176 (HUAA 21820)	
	0.3 km SW of Laguna Seca, 21°11'11.67"N, 102°38'11.30"W	Pine-oak forest	2698	González 1117 (HUAA 21791)	
	Cabañas Las Manzanillas, 1.99 km NW of El Zepo, 22°11'31.38"N, 102°36'47.64"W	Oak forest	2609	González 1112 (HUAA 21797)	
	Ranch El Sinai	Oak forest	1691	González & Rosales 1178 (HUAA 21829)	
	0.5 km NE of Laguna Seca	Oak forest	2698	González & Rosales 1187 (HUAA 21839)	
	Gully Los Planes, 22°3'14.56"N, 102°29'42.33"W	Pine forest	2400	García 2134 (HUAA 5576)	
	Gully "El Chupadero"	Oak forest	2400	García 2270 (HUAA 4986)	
	Gully de Juan Francisco; Sierra San Blas de Pabellón, 22°12'18.9"N 102°37'35.2"W	Pine-oak forest	2600	García 2292 (HUAA 6023)	
	Gully Pino	Oak forest	2100	De la Cerdá 5592 (HUAA 12213)	
	Gully La Boquilla, 1 km E of Rancho Las Camas	Oak forest	2140	De la Cerdá & García 587 (HUAA 21879)	
<i>Q. praeceo Trel.*</i>	Tepezalá	La Minerva	Temperate scrub with oak	2500	Rosales 10 (HUAA 1028)
	Calvillo	Around of Dam Los Alamitos, 21°43'55"N, 102°42'50"W	Oak forest	2360	De la Cerdá 7457 (HUAA 20918)
<i>Q. resinosa Liebm.</i>	Waterfall of Gully Boca Obscura, 21°46'28"N, 102°38'14"W			2332	Martínez-Ramírez 1588 (HUAA 29447)
	0.5 km S of Mesa del Roble, 21°44'51"N, 102°45'17"W			Oak forest	1928
	0.5 km NW of Dam Los Alamitos, 21°44'80.6"N, 102°41'09"W			Temperate shrub	2018
	Rincón de Romos			Oak forest	2350
	Gully Pabellón de Hidalgo, 22°13'08"N, 102°22'12"W			Temperate shrub	Martínez-Ramírez 1561 (HUAA 29454)
	San José de Gracia			Oak forest	González 1319 (HUAA 21853)
	Puerto Piñones			Pine-oak forest	Martínez-Ramírez 2640 (HUAA 29933)
	Gully Los Planes, Sierra de Guajolotes			Oak forest	De la Cerdá 4788 (HUAA 13185)
	Los Alamitos, Sierra Fría, 22°10'56"N, 102°36'39"W			Pine-oak forest	García 2335 (HUAA 5287)
	Rancho El Zepo (Sierra Fría), 22°11'04.55"N, 102°35'49.29"W			Oak forest	Martínez-Ramírez 1341 (HUAA 21111)
<i>Q. resinosa Liebm.</i>	0.5 km E of La Congoja			Oak forest	De la Cerdá & García 279 (HUAA 73)
	Bajío La Canoa, 3 km W of La Congoja, 22°10'13"N, 102°34'58"W			Temperate grassland	De la Cerdá 2490 (HUAA 4593)
	1 km SE of Agua Escondida, 22°11'02"N, 102°37'19"W			Coniferous forest	De la Cerdá 7563 (HUAA 21801)
	Cañada Mesa Montoro, 22°00'12"N, 102°33'52"W			Oak forest-grassland	Martínez-Ramírez 1991 (HUAA 28577)
	El Jaquey			Pine-oak forest	De la Cerdá 6548 (HUAA 16467)
	NW slope of Cerro del Picacho, 21°53'27.51"N, 102°25'23.65"W			Oak forest	De la Cerdá & García 1149 (HUAA 3826)
	1 km W of Ignacio Zaragoza, path to Cerro del Muerto, 21°51'41.2"N 102°27'32"W			Temperate scrub	De la Cerdá 1001 (HUAA 80)
	Hill Los Gallos, 500 m NW of antemnae, 21°39'54"N, 102°13'15"W,			Oak forest	González 1392 (HUAA 21852)
	El Ocote, 21°47'60"N, 102°31'57"W			Vestigial oak forest	González & Lucio 700 (HUAA 19709)
	2 km NW of El Ocote, 21°47'40.8"N, 102°31'49.9"W			Temperate scrub	Martínez-Calderón 84 (HUAA 29934)

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Table 1. Continued.

Section/species	Municipality	Localities	Plant communities	Elevation (m)	Voucher
<i>Q. rugosa</i> Née	Calvillo	Hillside E of Cerro de la Mesilla, Sierra del Laurel	Pine-oak forest	2470	Rodríguez 291 (HUAA 9556)
		Gully Tortugas	Subtropical scrub	1800	De la Cerdá & García 1667 (HUAA 1032)
		Gully La Botita. 4 km SE of Malpaso, 21°49'12.6"N, 102°38'40.0"W	Oak forest with elements of subtropical scrub,	1670	Martínez-Calderón 105 (HUAA 29935)
<i>El Llano</i>	Jesús María	Cerro Juan Grande, E of Palo Alto, 21°56'4.34"N, 101°54'32.87"W	Oak forest	2150	De la Cerdá & García 1230 (HUAA 1123)
		2 km SE of Dam Capulín, 21°49'48"N, 102°33'58"W 1.5 km SW of Dam San Rafael	Pine-oak forest Temperate scrub-oak	2000 2050	Vega 92 (HUAA 4063) Vega 197 (HUAA 4091)
<i>Q. rugosa</i> Trel.*	San José de Gracia	Laguna Seca, Sierra San Blas de Pabellón	Oak forest	2630	Gutiérrez 10 (HUAA 5469)
		1 km E of La Congoja	Temperate grassland	2600	De la Cerdá 2433 (HUAA 4288)
		Agua Zarca Biological Station, 22°05'35.58"N, 102°33'17.41"W	Oak forest	2200	Rosales 1482 (HUAA 16577)
		3 km NW of El Temazcal, 22°01'28.3"N, 102°44'14.72"W	Oak forest	2162	González & Rosales 1153 (HUAA 1153)
<i>Q. rugosa</i> Née	Calvillo	Los Alisos, 21°44'29"N, 102°43'42"W	Oak forest with elements of tropical forest	2035	Rosales 3808 (HUAA 23068)
		Gully Boca Oscura, 21°46'36"N, 102°38'25"W	Oak forest with elements of tropical forest	2200	De la Cerdá 7012 (HUAA 16811)
		El Pilar, 22°03'49.27"N, 102°44'10.93"W Los Alamitos, 21°43'64"N, 102°42'82"W	Oak forest Oak forest	2700 2300	García 1759 (HUAA 7037) De la Cerdá 6300 (HUAA 16446)
<i>Q. striatula</i> Trel.*	Jesus María	Stream El Mirador, 4 km W of Los Miradores	Oak forest	2344	Martínez-Ramírez 1956 (HUAA 29564)
		6.44 km SW of Zepo, 21°10'58.94"N, 102°35'48.9"W,	Oak forest	2618	González 1135 (HUAA 21784)
		Agua Zarca Biological Station (EBAZ), 22°05'35.38"N, 102°33'17.41"W	Oak forest	2200	Rosales 1752 (HUAA 21329)
		8.11 km N of Temazcal, 22°04'37.25"N, 102°43'28.50"W	Oak forest	2556	Adame-Rosales 1172 (HUAA 21823)
		Forest station, Sierra Fría	Oak forest	2583	Adame-Rosales 1175 (HUAA 21825)
		Gully La Boquilla, 1 km E of Rancho Las Camas	Oak forest	2140	De la Cerdá & García 587 (HUAA 21878)
		Cañada El Carrizal, NW of Paredes, 22°10'59"N, 102°30'13"W	Oak forest	2100	De la Cerdá 7386 (HUAA 20464)
		Mesa Alta, Monte Grande, Sierra Fría,	Oak forest	2973	Siqueiros 4061 (HUAA 4678)
		4 km SW of La Congoja, 22°09'04"N, 102°35'38"W	Oak forest	2600	De la Cerdá 6276 (HUAA 15182)
		Cerro "La Culebra"	Oak forest	2350	De la Cerdá 2774a (HUAA 5032)
		4 km W of Jaguey	Oak forest	2530	De la Cerdá & García 1079 (HUAA 1127)
		1.5 km SW of Gully de Vallecitos	Pine-oak forest	2448	Gutiérrez 77 (HUAA 5728)
		Gully El Rico, 5.7 km NW of La Congoja, 22°12'50.68"N, 102°34'21.13"W	Oak forest	2404	Martínez-Calderón 98 (HUAA 29936)
		Rincón de Romos	Pine-oak forest	2112	Siqueiros 4696 (HUAA 20047)
		San José de Gracia	Pine-oak forest	2574	De la Cerdá 7571 (HUAA 21813)
	Calvillo	8 km S of Tapias Viejas, Sierra del Laurel	Oak forest	2150	García 4506 (HUAA 13986)

***Quercus castanea* Née. Figure 4C.**

Quercus castanea NÉE (1801): 276. — GONZÁLEZ (1986): 40.
Q. circummontana TRELEASE (1924): 177. — GONZÁLEZ (1986): 40.
Q. rossii TRELEASE (1924): 179. — GONZÁLEZ (1986): 40.
Q. serrulata TRELEASE (1924): 179. — GONZÁLEZ (1986): 40.

Material examined: Table 1.

Tree of 10–15 m high. Leaf coriaceous of 3.5–11 × 1.2–7.5 cm, oblanceolate, with 2–9 awns at the leaf margin rarely entire, apex acute or rounded, ending in awn, upper surface lustrous and glabrescent with imprinted veins, undersurface whitish or yellowish, tomentose, base subcordate to rounded. Fruit biannual, cupule hemispherical, nut broadly ovoid 10–12 × 8–10 mm.

In México, this species is distributed in the states of Aguascalientes, Colima, Durango, Distrito Federal, Guanajuato, Guerrero, Hidalgo, Jalisco, México, Michoacan, Morelos, Nayarit, San Luis Potosí, Sinaloa, Sonora, Puebla, Oaxaca, and Veracruz. In Aguascalientes, it is found in the municipalities of Calvillo, Jesús María and San José de Gracia, in oak forest and manzanita shrubs, from 2000–2695 m.

***Quercus chihuahuensis* Trel. Figure 4D**

Quercus chihuahuensis TRELEASE (1924): 129–131. — GONZÁLEZ (1986): 48.
Q. jaliscensis TRELEASE (1924): 132. — GONZÁLEZ (1986): 48.

Material examined: Table 1.

Tree of 3–6 m high. Branchlets pubescent. Leaf coriaceous of (2)4–8(–12) × (1)2–4(–6) cm, obovate, oblong-obovate or elliptic, with mucronate or entire margin and apex obtuse or rounded, ending in mucrone, upper surface and lower surface both tomentose, base cordate, subcordate or rounded. Fruit annual, cupule hemispherical with margin entere, nut ovoid 13–20 × 8–13 mm.

In México, distributed in the states of Aguascalientes, Chihuahua, Durango, Jalisco, Nayarit, Nuevo León, San Luis Potosí, Sinaloa, Sonora, and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Calvillo, Jesús María, San José de Gracia, Rincón de Romos, and Pabellón de Arteaga, in oak, oak-pine, shrub, and grasslands from 1800–2900 m. It can be confused with *Q. deserticola*, however, *Q. deserticola* has imprinted vein pattern and more revolute leaf margins.

***Quercus depressipes* Trel. Figure 4E.**

Quercus depressipes TRELEASE (1924): 144. — MCVAUGH (1974): 32; GONZÁLEZ (1986): 75.

Material examined: Table 1.

Shrub of 0.80–1.5 m high. Leaf of (1)2.5–4(5) × (0.6)1–2(2.5) cm, oblong or obovate, with 3–5 mucronate teeth at the leaf margin, apex rounded or subacute, ending in mucrone, base cordate and sometimes round. It is easily distinguished in the field by its shrubby habit and glabrous leaves.

Distributed from west Texas to México, in the states of Aguascalientes, Chihuahua, Durango, Jalisco, and Zacatecas. In Aguascalientes, it has been found in the municipalities of Calvillo, Pabellón de Arteaga, and San José de Gracia, in oak forest, oak-pine forests, and is sometimes associated

with thorny or subtropical shrubland from 1900–2244 m. *Quercus depressipes* can form dense clumps of growth that are difficult to penetrate. It is easily distinguished in the field by its shrubby habit and glabrous leaves.

***Quercus deserticola* Trel. Figure 4F**

Quercus deserticola TRELEASE (1924): 79. — MCVAUGH (1974): 33; GONZÁLEZ (1986): 78.

Material examined: Table 1.

Tree up to 7 m high. Branchlets yellow-tomentose. Leaf coriaceous of (3.5)4.5–8.5(9.5) × (2.5)3–6(7) cm, oblong-oblanceolate or oblong-elliptic, with 5–7 mucronate teeth at the leaf margin, lobed and revolute, apex obtuse or rounded ending in mucrone, upper surface with veins impressed, upper surface and lower surface both tomentose, base cordate or rounded. Fruit annual, cupule hemispherical with margin entere, nut widely-ovoid 12–48 × 10–15 mm.

In México, the species is distributed in the states of Aguascalientes, Guanajuato, Hidalgo, Jalisco, México, Michoacán, Oaxaca, Puebla, Querétaro and Sinaloa. In Aguascalientes, it has been found in the municipality of Jesús María; associated with shrublands at 1910 m. *Quercus deserticola* is similar to *Q. chihuahuensis* (see comments in *Q. chihuahuensis*).

***Quercus durifolia* Seemen. Figure 4G**

Quercus durifolia SEEMEN (1900): 95. — SPELLENBERG et al. (1998): 371.

Material examined: Table 1.

Tree of 8 m high. Leaf coriaceous of 2.5–5 × 1–2.3 cm, elliptic or lanceolate, with entire margin, apex acute or obtuse ending in awn, upper surface lustrous and glabrescent, lower surface whitish tomentose that hides the bullate epidermis, base cordate or rounded. Fruit annual, cupule hemispherical with pubescent scales except near the apex, nut ovoid 18 × 10 mm.

In México, the species is distributed in the states of Aguascalientes, Chihuahua, Durango, Sinaloa and Sonora. In Aguascalientes, it was only found in the municipality of San José de Gracia in oak and oak-pine forests from 2400–2839 m. The diagnostic character of the species is an entire leaf margin with whitish underside of the leaf that contrasts with the dark-green upper side.

***Quercus eduardi* Trel. Figure 4H.**

Quercus eduardi TRELEASE (1922): 189. — MCVAUGH (1974): 35; GONZÁLEZ (1986): 82.

Material examined: Table 1.

Tree of 4–8 m high. In the field, it may be identified by the pubescent underside of the leaf that can be removed easily by rubbing; usually there are awns present on the leaf margin. However, there are some individuals with entire leaf margins, which can be confused with *Q. mexicana*. The leaf venation is not as evident as in *Q. eduardi*, which helps in differentiating the two species.

In México, the species is distributed in the states of Aguascalientes, Durango, Jalisco, Guanajuato, Nayarit,



Figure 4. **A.** *Quercus aristata* from Presa los Alamitos, Sierra del Laurel, Calvillo. **B.** *Quercus candicans* from Barranca Oscura, Calvillo. **C.** *Quercus castanea* from Barranca El Huarache 1.72 km NW de El Terrero del Refugio, Calvillo. **D.** *Quercus Chihuahuensis* from Barranca El Calderón, San José de Gracia. **E.** *Quercus deserticola* from Potrero del Rio, Jesús María. **F.** *Quercus depressipes* from Agua Zarca, San José de Gracia. **G.** *Quercus durifolia* from Barranca El Calderón, San José de Gracia. **H.** *Quercus eduardi* from Barranca El Calderón, San José de Gracia.

Querétaro, San Luis Potosí and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Calvillo, Jesús María, Pabellón de Arteaga, Rincón de Romos and San José de Gracia in oak, oak-pine, and juniper forests, grasslands and shrublands, from 1530–2618 m.

Quercus gentryi C.H. Mull. Figure 5A.

Quercus gentryi MULLER (1942): 474. — MCVAUGH (1974): 43; GONZÁLEZ (1986): 99.

Material examined: Table 1.

Tree of 8–15 m high. Leaf of 3–13 × 1–3.5 cm, narrowly elliptic or lanceolate, with entire margin, apex acute or obtuse, ending in awn, upper surface lustrous and glabrescent, lower surface glabrous except for trichomas along of midvein and bases of the large lateral veins, base acute or attenuated. Fruit biannual, cupule hemispherical with thickened and inrolled border, nut broadly-ovoid 18 × 12 mm.

In México, the species is distributed in the states of Aguascalientes, Durango, Guanajuato, Jalisco, Michoacán, Nayarit, Sinaloa and Zacatecas. In Aguascalientes, it has been found in the municipalities of Calvillo and Jesús María in oak forests from 2084–2625 m. In the field, can be identified by its large size, narrowly elliptic leaves and entire leaf margins.

Quercus greggii Trel. Figure 5B.

Quercus greggii TRELEASE (1922): 185. — ROMERO et al. (2014): 64. *Q. reticulata* var. *greggii* DE CANDOLLE (1864): 34. — ROMERO et al. (2014): 64.

Material examined: Table 1.

Shrub of 1.50 m high. Branchlets pubescent. Leaf of 2.5–4.5 × 1.3–3 cm, obovate or oblong-obovate, with entire margin sometimes with 1–4 short-mucrone at the leaf margin, apex obtuse or rounded, ending in mucrone, upper surface glabrescent with imprinted veins, lower surface tomentose and yellowish, base cordate or rounded. Fruit annual, cupule hemispherical with margin entire, nut ovoid 13 × 10 mm.

In México, this shrubby species is distributed in the states of Aguascalientes, Coahuila, Durango, Hidalgo, Nayarit, Nuevo León, Oaxaca, Puebla, San Luis Potosí, Tamaulipas and Veracruz. In Aguascalientes, it has been found only in the municipality of San José de Gracia in oak-pine forest at 2621 m.

Quercus grisea Liebm. Figure 5C.

Quercus grisea LIEBMANN (1854): 171. — MCVAUGH (1974): 48; GONZÁLEZ (1986): 112.

Material examined: Table 1.

Tree of 4–7 m high. Branchlets tomentose. Leaf subcoriaceous of (1)2–4(7) × (0.5)1–2(3) cm, elliptic, oblong-elliptic or obovate, with entire margin, rarely with mucrone, apex obtuse or rounded, ending in mucrone, base subcordate or rounded. In the field, can be identified by its small size, and its umbrella-like extended canopy, as well as by its gray foliage with entire leaf margin and pubescent leaves. Fruit

annual, cupule hemispherical, nut ovoid 12–18 × 8–12 mm.

Distributed from the southern USA to northern Mexico. In México, the species is found in the states of Aguascalientes, Chihuahua, Coahuila, Durango, Guanajuato, Jalisco, San Luis Potosí, Nuevo León, Sonora, Veracruz and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Calvillo, Cosío, Jesús María, San José de Gracia and Rincón de Romos in oak and pine-oak-juniper forests, usually associated with grasslands from 2100–2697 m.

Quercus jonesii Trel. Figure 5D.

Quercus jonesii TRELEASE (1924): 136. — MCVAUGH (1974): 25; GONZÁLEZ (1986): 52.

Q. coccobifolia TRELEASE (1924): 136. — GONZÁLEZ (1986): 52.

Q. endlichiana TRELEASE (1924): 141. — GONZÁLEZ (1986): 52.

Q. aerea TRELEASE (1924): 135. — GONZÁLEZ (1986): 52.

Material examined: Table 1.

Tree of 3–6 m high. Leaf coriaceous of (7)8–13(–18) × (5.5)7–15(–17) cm, broadly-ovate or suborbicular, entire margin or with 1–4 awns at the leaf margin, apex rounded, obtuse or apiculate, may end in awn or not, upper surface lustrous and glabrescent with imprinted veins, lower surface usually glabrous, base cordate or auriculate. Fruit annual, cupule hemispherical, nut ovoid 8–10 mm × 5–8 mm.

In México, the species is distributed in the states of Aguascalientes, Chihuahua, Durango, Guanajuato, Jalisco, Nayarit, San Luis Potosí and Sonora. In Aguascalientes, it has been found in the municipalities of Calvillo, Jesús María and San José de Gracia in limestone slopes in oak and pine-oak forests from 2400 to 2800 m. Always associated with *Pinus lumholtzii* Rob. et Fern.

Quercus laeta Liebm. Figure 5E

Quercus laeta LIEBMANN (1854): 179. — MCVAUGH (1974): 50; GONZÁLEZ (1986): 119.

Q. obscura TRELEASE (1924): 71. — GONZÁLEZ (1986): 119.

Q. pallescens TRELEASE (1924): 89. — GONZÁLEZ (1986): 119.

Q. transmontana TRELEASE (1924): 71. — GONZÁLEZ (1986): 119.

Material examined: Table 1.

Tree of 3–8 m high. Branchlets tomentose or glabrescent. Leaf subcoriaceous of (2.5)4–8(–14) × (0.6)2–3(–7) cm, oblong-obovate, oblanceolate, elliptic or lanceolate, with 3–5 mucronate teeth at the leaf margin and revolute, apex obtuse, rounded or acute, ending in mucrone, upper surface glabrescent, lower surface glabrescent or pubescent, base cordate, rounded or oblique. Fruit annual, cupule hemispherical with margin entire, nut elliptic-ovoid 15 × 8 mm.

In México, the species is distributed in the states of Aguascalientes, Coahuila, Distrito Federal, Durango, Guanajuato, Hidalgo, Jalisco, México, Michoacán, Nayarit, Nuevo León, Sinaloa, Oaxaca and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Calvillo, Jesús María, Pabellón de Arteaga and San José de Gracia, in oak, pine-oak, or pine forests, in temperate and subtropical shrublands and grasslands from 1900–2650 m. *Quercus*



Figure 5. *Quercus* gentry from 1 km W El Garruño, Calvillo. **B.** *Quercus greggii* from Agua Escondida, San José de Gracia. **C.** *Quercus grisea* from Milpillas de Arriba, Jesús María. **D.** *Quercus jonesii* from Monte Grande Sierra Fría, San José de Gracia. **E.** *Quercus laeta* from Barranca La Botita, Calvillo. **F.** *Quercus laurina* from Cerro El Pujido, San José de Gracia. **G.** *Quercus magnoliifolia* from Barranca La Botita, Calvillo. **H.** *Quercus Mexicana* from Barranca Juan Caporal, San José de Gracia.

laeta has diverse leaf polymorphism even in the same tree, which makes identification challenging. This species, as well as *Q. potosina* and *Q. eduardi* are the most widely distributed oaks in Aguascalientes.

***Quercus laurina* Bonpl. Figure 5F.**

Quercus laurina BONPLAND (1809): 32. — McVAUGH (1974): 53; GONZÁLEZ (1986): 125. *Q. barbinervis* BENTHAM (1840): 56. — GONZÁLEZ (1986): 125. *Q. caeruleocarpa* TRELEASE (1924): 163. — GONZÁLEZ (1986): 125. *Q. lanceolata* BONPLAND (1809): 34. — GONZÁLEZ (1986): 125. *Q. ocoteaefolia* LIEBMANN (1854): 176. — GONZÁLEZ (1986): 125.

Material examined: Table 1.

Tree of 10 m high. Branchlets glabrescent. Leaf of 4.5–8 × 2–3 cm, elliptic or elliptic-ob lanceolate, margin slightly revolute, serrate, with 2–4 awned on each side, apex acute ending in awn, upper surface lustrous and glabrous, lower surface glabrescent with trichomes on midvein, base rounded. Fruit biannual, cupule hemispherical, nut short-ovoid 15–17 × 10–12 mm.

In México, the species is distributed in the states of Aguascalientes, Guanajuato, Hidalgo, Jalisco, México, Michoacán, Oaxaca and Puebla. In Aguascalientes, it has been found in the municipalities of San José de Gracia in oak-pine forest from 2839 m.

***Quercus magnoliifolia* Née. Figure 5G.**

Quercus magnoliifolia NÉE (1801): 268. — McVAUGH (1974): 55; GONZÁLEZ (1986): 130. *Q. circinata* NÉE (1801): 272. — GONZÁLEZ (1986): 130. *Q. nudinervis* LIEBMANN (1854): 182. — GONZÁLEZ (1986): 130. *Q. macrophylla* NÉE (1801): 274. — GONZÁLEZ (1986): 130. *Q. hematophlebia* TRELEASE (1924): 66. — GONZÁLEZ (1986): 130. *Q. lutea* NÉE (1801): 269. — GONZÁLEZ (1986): 130. *Q. platyphylla* WARBURG (1939): 85. — GONZÁLEZ (1986): 130. *Q. tepicana* TRELEASE (1924): 255. — GONZÁLEZ (1986): 130.

Material examined: Table 1.

Tree of 5–8 m high. Leaf subcoriaceous (6–)10–16(18) × (5.5)7–12 cm, obovate, sometimes oblong-elliptic, with 9–15 mucronate teeth at the leaf margin, lobed and revolute, apex obtuse, ending in mucrone, upper surface lustrous, almost glabrous, lower surface tomentose, base oblique or cuneate. Fruit annual, cupule hemispherical and big, nut ovoid.

In México, the species is distributed in the states of Aguascalientes, Colima, Guerrero, Hidalgo, Jalisco, México, Michoacán, Nayarit, Oaxaca, Puebla, San Luis Potosí and Sinaloa. In Aguascalientes, it has been found in the municipality of Calvillo in oak forest with subtropical shrub elements from 1670–2541 m. *Quercus magnoliifolia* can be confused with *Q. resinosa* since they grow sympatrically and show leaf similarities. However, they can be differentiated by the longer and glabrescent petioles and twigs in *Q. magnoliifolia*, contrasting with the persistent tomentum in *Q. resinosa*.

***Quercus mexicana* Bonpl. Figure 5H.**

Quercus mexicana BONPLAND (1809): 35. — ROMERO et al. (2014): 92.

Q. pabillensis MULLER (1942): 477. — ROMERO et al. (2014): 92. *Q. rugulosa* MARTENS & GALEOTTI (1843): 209. — ROMERO et al. (2014): 92.

Material examined: Table 1.

Tree of 10 m high. Leaf subcoriaceous, elliptic of (1.5)3–5 × (0.7)1–1.7 cm, with entire margin, apex obtuse or acute, ending in awn, upper surface lustrous and glabrescent with imprinted veins, lower surface pubescent that can be removed easily by rubbing, base subcordata. Fruit biannual, cupule hemispherical, nut ovoid.

In México, the species is distributed in the states of Aguascalientes, Coahuila, Distrito Federal, Hidalgo, México, Nuevo León, Puebla, Querétaro, San Luis Potosí, Tamaulipas, Tlaxcala and Veracruz. In Aguascalientes, it has been found only in the municipality of Rincón de Romos in oak forest from 2112 m. In the field, can be identified by leaves with entire margins and the pubescence of the lower leaf surface that can be easily removed by rubbing. May be confused with *Q. eduardi*, which has a similar aspect.

***Quercus obtusata* Bonpl. Figure 6A.**

Quercus obtusata BONPLAND (1809): 76. — McVAUGH (1974): 60; GONZÁLEZ (1986): 145; ROMERO et al. (2014): 100. *Q. atriglans* WARBURG (1939): 88. — ROMERO et al. (2014): 100. *Q. crenatifolia* TRELEASE (1924): 57. — GONZÁLEZ (1986): 145. *Q. panduriformis* TRELEASE (1924): 62. — GONZÁLEZ (1986): 145. *Q. innuncupata* TRELEASE (1924): 77. — GONZÁLEZ (1986): 145.

Material examined: Table 1.

Tree of 8–18 m high. Leaf coriaceous, obovate to elliptic of (5–)9–20(24) × (3)6–12(17) cm, with 6–8 mucronate teeth at the leaf margin slightly revolute, undulate, apex obtuse or rounded, ending in mucro, upper surface lustrous and glabrescent with few red and glandular trichomes, lower surface with many red and glandular trichomes, base cordata or rounded. Fruit annual, cupule hemispherical, nut ovoid (12–)17–20 × (10–)15–18 mm.

In México, the species is distributed in the states of Aguascalientes, Durango, Guerrero, Guanajuato, Hidalgo, Jalisco, México, Michoacán, Morelos, Nayarit, Nuevo León, Oaxaca, Puebla, Querétaro, San Luis Potosí, Veracruz and Zacatecas. In Aguascalientes, it has been found in the municipalities of Calvillo and San José de Gracia in oak forest and oak forest associated with manzanita from 2256–2700 m.

***Quercus potosina* Trel. Figure 6B.**

Quercus potosina TRELEASE (1924): 84. — McVAUGH (1974): 58; GONZÁLEZ (1986): 160.

Material examined: Table 1.

Tree of 2–7 m high. Leaf coriaceous, obovate, oblong or oblanceolate of (2–)4–8(–12) × (1.5)2–5(–9) cm, with 4–6 mucronate teeth at the leaf margin sometimes revolute, apex rounded or obtuse, ending in mucro, upper surface lustrous and lower surface glabrescent with many red and glandular trichomes, base cordata. Fruit annual, cupule hemispherical, nut ovoid 12–20 × 10–15 mm.

In México, the species is distributed in the states of Aguascalientes, Chihuahua, Durango, Guanajuato, Jalisco

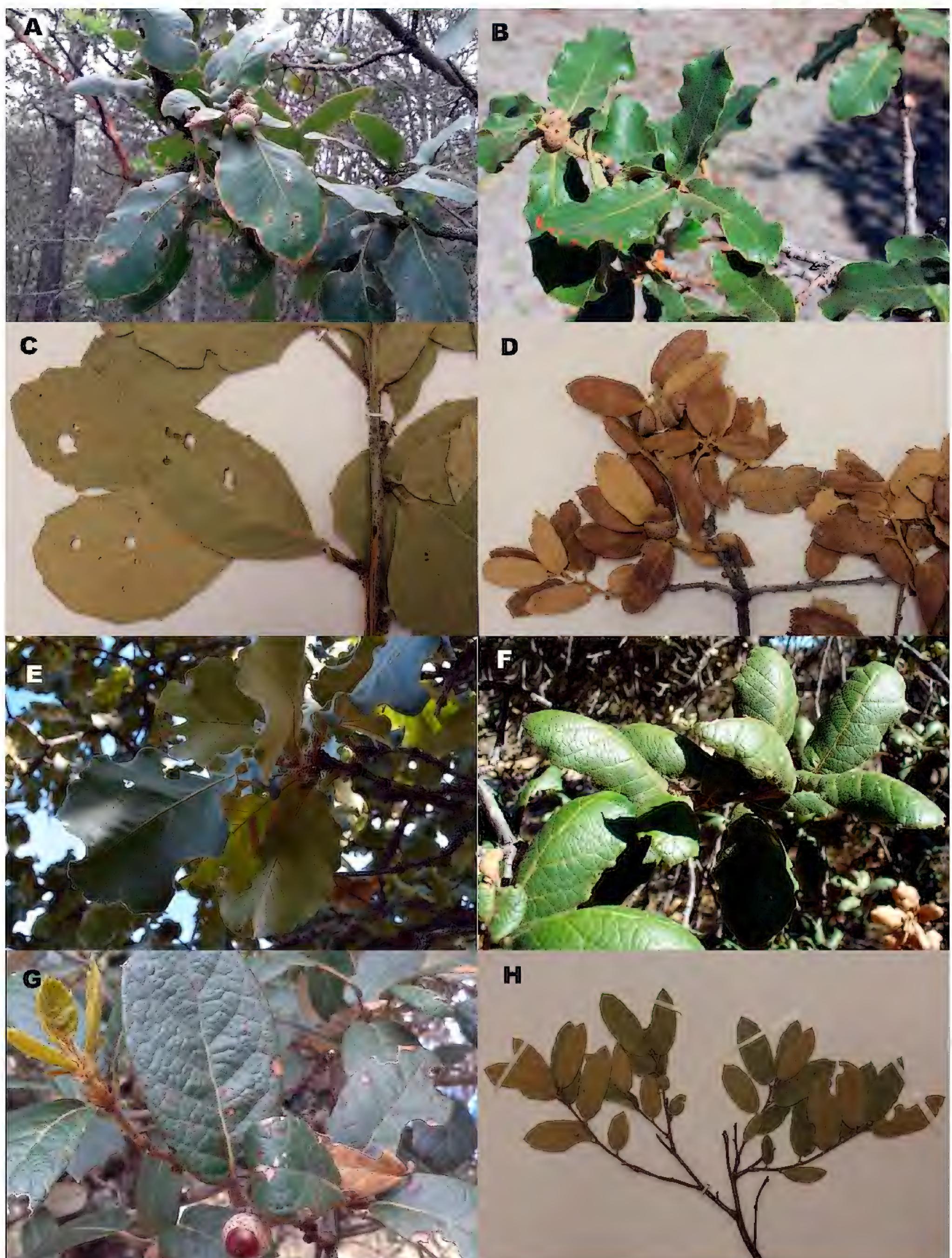


Figure 6. **A.** *Quercus obtusata* from Barranca Oscura, Calvillo. **B.** *Quercus potosina* from Agua Zarca, San José de Gracia. **C.** *Quercus praeco* from Los Alamitos, Calvillo. **D.** *Quercus repanda* from El Zepo, Sierra Fría, San José de Gracia. **E.** *Quercus resinosa* from Barranca La Botita, Calvillo. **F.** *Quercus rugosa* from Agua Zarca, San José de Gracia. **G.** *Quercus sideroxyla* from Sierra Fría, San José de Gracia. **H.** *Quercus striatula* from Los Alamitos, San José de Gracia.

and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Asientos, Calvillo, Cosío, El Llano, Jesús María, San José de Gracia and Tepezalá in oak, pine-oak, juniper forests, temperate and subtropical shrubs from 1890–2900 m. This is the most widely distributed species in Aguascalientes and usually is associated with *Q. laeta* and *Q. eduardi*. It can be identified by the large number of red glandular trichomes in young leaves. *Q. potosina* often grows in ramets.

***Quercus praeco* Trel. Figure 5C.**

Quercus praeco TRELEASE (1924): 88 — McVAUGH (1974): 70; GONZÁLEZ (1986): 164.

Material examined: Table 1.

Tree of 4–5 m high. Branchlets pubescent. Leaf obovate or oblong-obovate of (2.5)4–9 × (1.5)2–5.5 cm, with 3–5 mucronate teeth at the leaf margin, revolute, apex obtuse or rounded, ending in mucrone, upper surface dark green, pubescent with imprinted veins, lower surface tomentose and whitish, base cordate or rounded. Fruit annual, cupule bell-shaped, nut ovoid 17–20 × 10–15 mm.

In México, the species is distributed in the states of Aguascalientes, Jalisco, Nayarit, San Luis Potosí and Zacatecas. In Aguascalientes, it has been found in the municipalities of Calvillo and Rincón de Romos in oak forest and temperate shrub from 2018–2360 m.

***Quercus repanda* Bonpl. Figure 6D.**

Quercus repanda BONPLAND (1809): 31. — ROMERO et al. (2014): 128. *Q. subtriloba* TRELEASE (1924): 81. — ROMERO et al. (2014): 128.

Material examined: Table 1.

Shrub of 0.30–1.60 m high. Branchlets tomentose or glabrescent. Leaf of (1.5)2.5–5 × (0.7)1–2.5(3.5) coriaceous, ovate, obovate or oblong-elliptic, with entire margin sometimes with 1–4 short-mucrone at the leaf margin, apex obtuse or rounded, ending in mucrone, upper surface lustrous glabrescent with imprinted veins, lower surface tomentose and yellowish, base cordate or rounded. Fruit annual, cupule hemispherical with margin entire, nut ovoid 10–14.5 × 9–11 mm.

In México, the species is distributed in the states of Aguascalientes, Hidalgo, Puebla, San Luis Potosí and Tlaxcala. In Aguascalientes, it has been found in the municipalities of Calvillo and San José de Gracia, in oak, pine-oak forest, oak manzanita shrub and grasslands from 2250–2750 m. In the field, it can be identified by its shrubby rizomatous habit, leaves with yellow lower surface due to yellow dense indumentum, and 2–4 mucronate teeth at the leaf margin.

***Quercus resinosa* Liebm. Figure 6E.**

Quercus resinosa LIEBMANN (1854): 182. — McVAUGH (1974): 73; GONZÁLEZ (1986): 172.

Material examined: Table 1.

Tree of 6–10 m high. Leaf subcoriaceous of (10)13–28(30) × (5–)8–18(20) cm, obovate, sometimes oblong-elliptic,

with 8–18 mucronate teeth at the leaf margin, lobed and revolute, petioles tomentose, apex obtuse, rounded or acuminate, ending in mucrone, upper surface sometimes lustrous, glabrous, lower surface tomentose, base subcordate. Fruit annual, cupule hemispherical and big, nut ovoid 15–32 × 15–20 mm.

In México, the species is distributed in the states of Aguascalientes, Durango, Guanajuato, Jalisco, Michoacán, San Luis Potosí and Zacatecas. In Aguascalientes, it has been found in the municipalities of Aguascalientes, Calvillo, El Llano, Jesús María and San José de Gracia.

This species inhabits drier areas and lower elevations compared to the other oak species, and is found in lowlands oak forests, shrublands and grasslands from 1670–2600 m. It usually forms homogeneous populations associated to *Q. eduardi* and sometimes *Q. magnoliifolia* with which it can be confused.

***Quercus rugosa* Née. Figure 6F.**

Quercus rugosa NÉE (1801): 275. — McVAUGH (1974): 75; GONZÁLEZ (1986): 178; ROMERO et al. (2014): 135.

Q. conglomerata TRELEASE (1924): 77. — GONZÁLEZ (1986): 178.

Q. reticulata BONPLAND (1809): 40. — ROMERO et al. (2014): 135.

Q. decipiens MARTENS & GALEOTTI (1843): 214. — ROMERO et al. (2014): 135.

Q. purpusii TRELEASE (1924): 76. — GONZÁLEZ (1986): 178.

Material examined: Table 1.

Tree of 7–13 m high. Leaf concave, very coarse, thick and rigid, obovate, elliptic-obovate of (3)5–12(–18) × (2)3–8(10) cm, with 5–8 mucronate teeth at the leaf margin, apex rounded or obtuse, ending in mucrone, upper surface sometimes lustrous and glabrescent, lower surface with red or yellow glandular trichomes, base cordata or rounded. Fruit annual, cupule hemispherical, nut ovoid-narrow of 10–25 × 8–13 mm.

Distributed from western Texas, southern Arizona to México. In México, found in the states of Aguascalientes, Coahuila, Chihuahua, Durango, Distrito Federal, Guanajuato, Hidalgo, Jalisco, Michoacán, México, Puebla, Veracruz and Zacatecas. In Aguascalientes, it occurs in the municipalities of Calvillo, San José de Gracia and Rincón de Romos. It inhabits oak, pine-oak, oak-juniper forests, mainly on humid ravine slopes, and in subtropical oak forests from 2019–2900 m. In the field, it can be distinguished by leaves that are concave, very coarse, thick and rigid.

***Quercus sideroxyla* Bonpl. Figure 6G.**

Quercus sideroxyla BONPLAND (1809): 39. — McVAUGH (1974): 82; GONZÁLEZ (1986): 194.

Q. incarnata TRELEASE (1924): 126. — McVAUGH (1974): 82.

Material examined: Table 1.

Tree of 8–15 m high. Leaf oblanceolate, oblong-elliptic or obovate thick and rigid of (2.5)4–8(13) × (1.5)2.5–4(7.5) cm, with 1–5 awns teeth at the leaf margin revolute, rarely entire, apex obtuse or subacute, ending in awn, upper surface lustrous and glabrous with imprinted veins, lower surface whitish or yellowish, tomentose, base cordate or

rounded. Fruit biannual, cupule hemispherical, nut ovoid $10-15 \times 10$ mm.

In México, the species is distributed in the states of Aguascalientes, Chihuahua, Coahuila, Durango, Guanajuato, Jalisco, Nayarit, Nuevo León, San Luis Potosí, Sonora, Tamaulipas and Zacatecas. In Aguascalientes, it has been found in the municipalities of Calvillo, Jesús María and San José de Gracia in oak, pine-oak, oak-juniper forest on humid slopes from 2300–2867 m.

***Quercus striatula* Trel. Figure 6H.**

Quercus striatula TRELEASE (1924): 93. — VALENCIA (2004): 52.

Material examined: Table 1.

Shrub of 60 cm high. Branchlets pubescent. Leaf of $(1.5-)$ 3–4.5 \times 1–1.5 (-2) cm, subcoriaceous, elliptic or oblong, margin entire and slightly revolute, sometimes with 1–2 short-mucrone at the leaf margin, apex obtuse or acute, ending in mucrone, upper surface some lustrous, glabrescent with imprinted-veins, lower surface paler and tomentose, base cordate or rounded. Fruit annual, cupule hemispherical with margin entire, nut ovoid-elliptic of $8-15(-16.5) \times 7.5-11(-13)$ mm.

In México, the species is distributed in the states of Aguascalientes, Chihuahua, Durango and Zacatecas. In Aguascalientes, it has been found in the municipalities of San José de Gracia and Jesús María in oak, oak-pine forests from 2150–2574 m.

***Quercus viminea* Trel. Figure 7.**

Quercus viminea TRELEASE (1924): 123. — McVAUGH (1974): 91; GONZÁLEZ (1986): 213.

Q. bolanyosensis TRELEASE (1924): 223. — GONZÁLEZ (1986): 213.

Material examined: Table 1.

Tree of 10–15 m high. Leaf lanceolate or linear lanceolate of $(4)8-13(-17.5) \times (0.7)1-3(5.5)$ cm, yellowish green, coriaceous, with margin strongly thickened but not revolute, entire or with 1–3 aristate teeth, apex attenuate or narrowly acute, base cordate or subcordate; upper surface lustrous, glabrous or with some small trichomas, lower

surface paler and yellower, glabrescent with trichomas in the axils of the large veins. Fruit biannual, cupule hemispheric, nut elongated-ovoid 11×7 mm.

In México, this species occurs in the states of Aguascalientes, Chihuahua, Durango, Guanajuato, Jalisco, Nayarit, San Luis Potosí, Sinaloa, and Sonora. In Aguascalientes, it is only found in the municipality of Calvillo in oak, pine-oak forests in Sierra del Laurel, from 2350–2460 m.

DISCUSSION

As shown here, the white oaks are more diverse than the red oaks in Aguascalientes. According to ZAVALA (1998), the western part of México has a higher concentration of white oak species than red oaks. Nationally, there are 81 species in *Quercus* sect. *Quercus* (white oaks) and 76 species in *Quercus* sect. *Lobatae* (red oak) (VALENCIA 2004). NIXON (1993b) briefly mentions a scarcity of red oaks in relatively dry areas, such as Aguascalientes, as opposed to the white oaks, which often are dominant. The municipalities with the greatest number of white oak species are at higher elevations in the western part of the state. The white oaks are found in dryer areas than the red oaks (from 1800–2900 m), with the exception of *Q. rugosa*, which is located on humid north-facing slopes or in areas that transition between temperate and subtropical forest. The most abundant oak species in Aguascalientes are *Q. potosina* and *Q. laeta*, which are white oaks, and usually associated to *Q. eduardi* or *Juniperus deppeana*. All the shrubby oaks in the state are in *Quercus* sect. *Quercus*, such as *Q. depressipes*, *Q. greggii*, *Q. repanda*, and *Q. striatula*, and found in oak, oak-pine forests from 1900–2750. On the other hand, the red oaks are distributed in more humid areas and usually at higher elevations (from 2000–2800 m) with the exception of *Q. aristata* and *Q. eduardi* that grow at lower elevations (from 1530 m). *Quercus eduardi* is the most abundant red oak, in contrast to *Q. durifolia* and *Q. laurina*, which are the scarce. *Quercus durifolia* is found at the base of hillsides and is associated with *Q. rugosa* and *Q. grisea*. *Quercus candicans*, *Q. castanea*, *Q. gentryi* and *Q. viminea* are distributed in subtropical habitats in the municipality of Calvillo. *Quercus jonesii* is located in isolated patches on rocky slopes and limestone. It is generally associated with *Pinus lumholtzii* (DE LA CERDA 1999b) and *Q. sideroxyla* and is located in the highest parts of Sierra Fría, where it grows in shaded ravines. It is usually associated with pine species.

An extensive field exploration in all municipalities of Aguascalientes, plus the availability of expanded literature and herbarium type specimens, led to the report of 10 oak species that had not been found previously in the state. *Quercus crassifolia* and *Q. microphylla* were reported before (DE LA CERDA 1999b), but samples identified as *Q. crassifolia* turned out to be *Q. potosina*. Specimens identified as *Q. microphylla* were misidentified; some were determined to be *Q. repanda* and others *Q. striatula*. Errors in identification are common in oaks since several species resemble each other and can easily be confused. The



Figure 7. *Quercus viminea* from Arroyo Ojocalentillo, Calvillo.

oaks are regarded as a challenging group because of their complicated taxonomy and their morphological variability (even within the same individual tree!). It has been noted that several closely related species have the ability to hybridize (GONZÁLEZ 1993; VALENCIA 2004; ZAVALA 1998). Another difficulty is the inaccessibility of, or lack of details provided by, the type material and protologue (VALENCIA 2004); thus, some species are poorly known (ZAVALA 1998).

Furthermore, several species that are found in Aguascalientes can be easily confused in the field. *Quercus chihuahuensis* and *Q. deserticola* are morphologically similar, however, imprinted veins on the adaxial surface of *Q. deserticola* can differentiate both species. Another example includes *Q. eduardi* and *Q. mexicana*. Both are large trees with bright green foliage with leaves that are pubescent on the underside (the pubescence can be easily removed by rubbing). However, *Q. mexicana* has imprinted veins on the adaxial leaf surface. *Quercus resinosa* and *Q. magnoliifolia*, are similarly alike, but they can be differentiated because *Q. resinosa* has petioles and tomentose twigs, while *Q. magnoliifolia* has glabrous twigs and petioles and bulletted epidermis. DE LA CERDA (1999) pointed out that *Q. laeta* and *Q. potosina* are difficult species to identify due to their great morphological variability. These species also can be found in the form of shrubs in higher elevations. They have a wide distribution and are found in many vegetation types transitioning from oak forest to subtropical climates at elevations from 1900–2700 m (2900 m for *Q. potosina*).

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